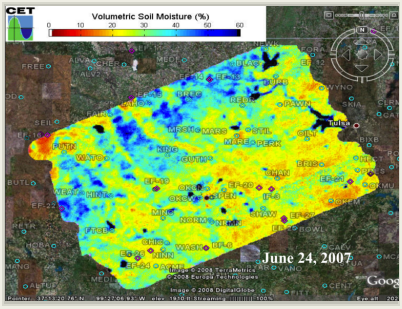
Small Business Innovation Research/Small Business Tech Transfer

Soil Moisture Mapping sUAS, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

The overall technical goal of this SBIR is the development of a commercially viable, small Unmanned Aircraft System (sUAS) with a passive microwave sensor to enable high resolution mapping of soil moisture content. Current remote-sensing methods for sampling soil moisture often fail to provide measurements with adequate spatial and temporal resolution, or any indication of moisture content at typical root depths. This work involves the integration of existing sensor, airframe, and autopilot technologies to construct a novel sensing platform. The scientific payload will be a passive microwave sensor in the L-band to map soil moisture content. The airframe utilized is the Tempest, originally designed for sampling tornadic thunderstorms and is a robust, easy to operate design that can takeoff and land on unimproved surfaces. The avionics will be based on the SwiftPilot system which consists of an autopilot board, wireless link for communication, command and control, ground station, and tablet based user interface. The SwiftPilot system provides a simple, intuitive interface for conducting sUAS missions making it ideal for scientific applications. Tight integration of the sensor with the sUAS avionics and airframe will enable precise flight control for low altitude missions in the range of 15m-30m above ground level (AGL) enabling the sensor to accurately map soil moisture with a resolution approaching 15m. The PI's working knowledge of the regulatory environment surrounding sUAS will be used to inform the development of the system and associated concept of operations. This will facilitate operation in the national airspace following FAA approval. The technical goal of this Phase I proposal is to design the interfaces; mechanical, electrical, and software required for integration of the sUAS. This will include the design of experiments for testing and validating this unique sensing platform in Phase II to assess the the performance in the desired scientific missions.



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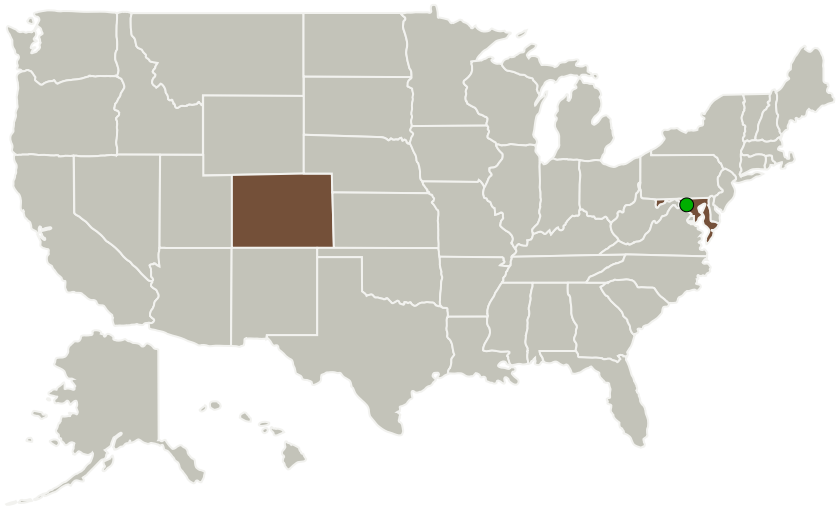
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Black Swift Technologies, LLC	Lead Organization	Industry	Boulder, Colorado
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Colorado	Maryland

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140459)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Black Swift Technologies, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

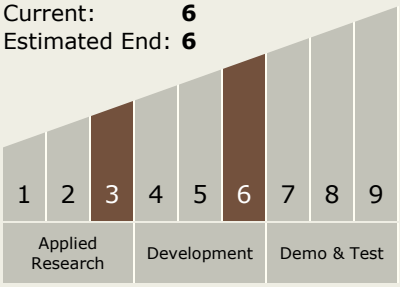
Carlos Torrez

Principal Investigator:

Maciej Stachura

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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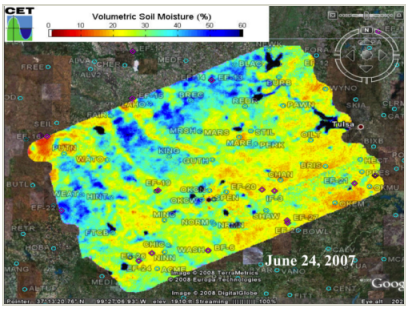
Images



Project Image
Soil Moisture Mapping sUAS
(https://techport.nasa.gov/image/131111)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System